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AMERICAN FERTILIZER

" That man is a benefactor to his race who makes two blades of grass to grow where but one grew before."

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Determination of Potash in Fertilizers or Base Goods*

In the Absence of Ammonium Salts and Organic Matter

By PHILIP McG. SHUEY, Shuey & Company, Savannah, Ga.

THE proposed method for determining potash in fertilizers and base goods removes the calcium, iron, and aluminum as phosphates, after boiling in water, instead of removing the calcium as oxalate. Only one subsequent evaporation and no ignition are necessary; therefore there is no possible loss of K_2O by decrepitation or volatilization and the time and attention required in these operations are saved. In short, the determination is the same as in the case of potash salts, except that a little mono-, di-, or trisodium phosphate or phosphoric acid is added, followed by the addition of dilute sodium hydroxide until the solution is permanently alkaline to litmus.

A small amount of additional phosphate or phosphoric acid is needed to effect complete precipitation of the calcium, because calcium occurs in phosphate rock and superphosphate in excess of the P_2O_5 required to combine with it.

The method has been found repeatedly to yield very accurate and concordant results in the absence of ammonium salts and organic matter—e. g., in mixtures of superphosphate and potash salts. The test for the presence of ammonia may be made in an instant by simply adding sodium hydroxide to a hot aqueous solution of a portion of the sample and noting the odor. The appearance and odor of the sample itself will at once reveal the presence or absence of organic matter such as tankage, vegetable meal, etc.

*Reprinted from Analytical Edition, "Industrial and Engineering Chemistry," October 15, 1943.

The method is particularly useful because it is necessary for a manufacturer first to make a base when using considerable quantities of potassium sulphate, owing to the setting properties of the sulphate.

Five grams of the prepared sample are transferred to a 500-ml. flask, or 2.5 grams to a 250-ml. flask, and boiled for half an hour with approximately 350 or 200 ml., respectively, of distilled water; 30 ml. of a 2 per cent solution, or 6 ml. of a 10 per cent solution, of sodium phosphate are added, followed by dilute sodium hydroxide while the flask is whirled until the solution is permanently alkaline to litmus. If the solution again becomes acid on standing, more sodium hydroxide should be added, avoiding a large excess. The flask is then allowed to cool, the solution is made up to the mark, mixed, and filtered, and an aliquot of 25 ml., equivalent to 0.25 gram, is pipetted into a casserole or dish other than platinum; the platinic chloride and a few drops of hydrochloric acid are added, and the determination is completed according to the official method for K_2O in potash salts (2). Just before filtering, it is advisable to grind the precipitate lightly with a small pestle in order to remove excess platinum chloride and facilitate subsequent purification with ammonium chloride solution.

Table I reports determinations made to show the accuracy of the method.

Contamination amounting to 0.15 per cent due to dissolved silicates was found in the caustic soda in the case of base goods containing superphosphate made from Florida

rock; therefore this amount was deducted. It is advisable to know the amount of dissolved glass in the sodium hydroxide used when not freshly made up and to make the necessary correction when the precipitate is not dissolved with hot water.

In analyzing the samples of base goods containing superphosphate made from Tennessee brown rock and triple superphosphate made from Idaho rock, fresh sodium hydroxide solution was made up from pure sticks; no silica whatever was found in the precipitates. All precipitates from these determinations were dissolved in hot water, and after drying, the Gooch crucibles were found to weigh the same as they did originally.

The strength of the alcohol used in all cases was 95 per cent. According to Scott (2) "too large a volume of alcohol should be avoided, as K_2PtCl_6 is slightly soluble in alcohol, especially that of 80 per cent. For this reason 95 per cent alcohol is preferable for the washing." Fresenius states that "potassium platinic chloride is not absolutely insoluble even in strong alcohol."

Since the Lindo-Gladding method of purifying the precipitate is effective, the presence of a small amount of lime does not interfere. For instance, 20.23 per cent K_2O was found in the sample of potassium sulphate base when all the calcium had not been precipitated,

TABLE I

Determination of Potash

	K_2O Official %	K_2O Modified %
Base goods made in proportion of 1255 pounds of superphosphate and 745 pounds of C. P. K_2SO_4, having theoretical analysis of 20.13%. Superphosphate from Florida land pebble rock	20.02 20.05	20.20 20.21
Av.	20.035	20.205
Base goods made in proportion of 1255 pounds of superphosphate and 745 pounds of C. P. K_2SO_4, having theoretical analysis of 20.13%. Superphosphate from Tennessee brown rock	20.24 20.24	20.20 20.15
Av.	20.24	20.175
Base goods made in proportion of 1255 pounds of triple superphosphate and 745 pounds of C. P. K_2SO_4, having theoretical analysis of 20.13%. Triple superphosphate from Idaho rock	20.31 20.32	20.32 20.37
Av.	20.315	20.345
Potassium sulphate-magnesia base. Superphosphate from Florida land pebble rock	11.05 10.93	10.97 10.95
Av.	10.99	10.96

compared with 20.20 per cent when precipitation was complete.

When a large excess of platinum chloride is not added, some of the sodium will form sodium platinic chloride (Na_2PtCl_6) and some may remain as sodium chloride. In either case, the sodium is freed from the precipitate when the official method is followed. Equal weights of pure sodium chloride and pure potassium chloride were boiled in a flask with water, and slightly more platinum chloride was added to the aliquot than that required to combine with the potash; the result was 63.18 per cent K_2O as against 63.17 per cent theory. A large excess of platinic chloride is unnecessary. It is only necessary to have such excess as is readily shown by the color after evaporation, especially after the acidified alcohol has been added.

The dish or casserole should be removed from the steam bath soon after evaporation, in order to prevent the formation of insoluble compounds. The addition of a small amount of glycerol has been recommended, but the author has not investigated this point.

While the weighed portions of the samples were being boiled with water, they had a tendency to ball or lump, retarding or preventing complete extraction of the potash. In the case of the triple superphosphate base sample, lumping persisted throughout the entire half-hour boiling period. When the solution was made by adding alternately small portions of the weighed charge of the sample and water, and quickly giving the flask a whirl immediately after each addition of water, there was no caking during boiling. It appears that lumps of calcium sulphate, which is not very soluble in either hot or cold water, are formed by the reaction between monocalcium phosphate and potassium sulphate. The fact that triple superphosphate is very high in monocalcium phosphate supports this view. The reaction may be expressed as follows:

$$Ca(H_2PO_4)_2 + K_2SO_4 = CaSO_4 + 2KH_2PO_4$$

A weighed portion is boiled with ammonium oxalate according to the official method to prevent loss by the action of the colloids, but in the case of high-analysis base goods, the potassium sulphate has the same effect, and complete recovery of the potash is obtained.

In making up the 20 per cent base mixtures, the same kind and amount of potassium sulphate were used in all cases. The slightly different results may largely be ascribed to differences in composition of the phosphate rock deposits. According to Jacob et al. (1),

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The Effect of Liming Materials Upon the Solubility of Potassium Compounds in the Soil

By DR. W. H. MacINTIRE, Tennessee Experiment Station, Knoxville, Tennessee

FOR many years it has been taught that liming causes the native supplies of potassium in the soil to become more available to plant growth through direct chemical changes. This teaching came largely as an interpretation of laboratory results into terms of what transpires in soils under field conditions. It is true that a laboratory suspension of an acidic soil in a solution of neutral salts of calcium and magnesia will bring about the release of some potassium. But, the extent of this release falls far short of the potential liberative capacity of the neutral salts, even under the intensified conditions imposed in the laboratory suspensions. Moreover, the intensity of the laboratory conditions, including concentration of the neutral salt solution, would not be attained in the soils of the field. Since the formation of calcium and magnesium salts is promoted as a result of bacterial activation in limed soils, it was concluded that these generated neutral salts would induce a liberation of soil potassium under field conditions. That conclusion has not been proved.

The present discussion deals with a 26-year accumulation of evidence that points to the opposite conclusion. The results given represent lysimeter findings obtained by the analyses of the rainwater leachings from an annual precipitation of 51 inches at the Tennessee Experiment Station. It is emphasized that the content of the free soil-water can be taken as an index of the nutrient content that will be taken up by plants grown in soil under similar treatment and conditions. The plant acquires its nutrients from the source that offers the least resistance. That is, the plant follows a natural bent and obtains its mineral nutrients by the expenditure of the minimum of effort necessary to acquire them. If the nutrients are present in the dissolved state, the plant need not draw upon the solid materials of the soil. Therefore, the concentration of an element in the free soil-water will be reflected by a corresponding incidence of that element in the plant ash.

Experimental Results from Limings at Rational Rates

All of the experimental results will be expressed in terms of either potassium (K) or potassium oxide (K_2O) per 2,000,000 pounds of fallow soil. The data of Table 1 give the amount of potassium leached from a fallow Cumberland silt loam soil over a 23-year period, subsequent to a single full-depth liming with four liming materials at the equivalent rate of one ton of burnt lime.

Each of the four liming materials caused a

TABLE 1—AMOUNTS OF K LEACHED—LBS. PER 2,000,000 LBS. OF FALLOW SOIL

	Soil only	Limestone	Dolomite	Burnt lime	MgO
Outgo during the first 12 years, no treatment other than liming	101	95	80	87	73
Outgo during next 11 years, with annual additions of 16 lbs. of K, as K_2SO_4	1138	988	983	965	1017

TABLE 2—AMOUNTS OF K LEACHED—LBS. PER 2,000,000 LBS. OF FALLOW SOIL

	Soil only	$FeSO_4$ only	$FeSO_4$ + CaO	$FeSO_4$ + MgO
Outgo during the first 12 years, no treatment other than liming	101	99	74	79
Outgo during the next 11 years, with annual additions of 166 pounds of K, as K_2SO_4	1138	1130	994	964

repression in the outgo of potassium in the leachings during the first 12 years, wherein the sole additive treatment was a single liming material. An addition of 166 pounds of K was made at the beginning of each of the next 11 years. From this total addition of 1826 pounds of K, a 1138-pound recovery came from the unlimed soil. This recovery was substantially greater than that from each of the four liming materials. The persistence of the repressive effect exerted by each of the liming materials upon potassium outgo is evident, even after 12 years. Each residue of the four materials was still potent enough to diminish the concentration of potassium in the leachings, in spite of the large input of potassium sulphate during the last 11-year period.

The data given in Table 2 were obtained from the same soil and experiment as in Table 1. In this series, the single addition of ferrous sulphate was made alone and with lime and with magnesia in respective amounts capable of neutralizing the acidic iron salt and still supply an initial liming at the equivalent rate of 2000 pounds of CaO.

The data of Table 2 show that no definite release of potassium was obtained from the relatively small exchangeable K content of this soil as the effect of an amount of ferrous sulphate capable of generating 4250 pounds of calcium sulphate. Moreover, when the calcium sulphate was used jointly with burnt lime, or with an equivalence of burnt magnesia, any liberative tendency of the acidic ferrous sulphate was nullified and the repressive effect of these two liming materials was still definite. Moreover, the same order of results was indicated as an effect of the residue of the added burnt lime and burnt magnesia that remained after 12 years' exposure to rainwater. This effect of the residues of the liming treatments continued to show throughout the succeeding 11 years of the experiment, during which period annual additions of 166 pounds of potassium were made in the form of potassium sulphate.

In Table 3, the effect of a single 2-ton $CaCO_3$ addition of limestone, and that of a corresponding addition of dolomite, were registered by the amounts of K recovered from ten 229-pound annual additions of K as potassium sulphate.

The data of Table 3 show that limestone and dolomite caused a decrease in the potassium outgo from these 10 annual additions. Repressive effect upon leachability was registered by both limestone and dolomite upon the 10 corresponding annual additions of potassium at the double rate of 458 pounds of K per acre per annum. These results demonstrate once more that the addition of liming materials tends to put into the soil a part of the added potassium salt, and that the soil retains some of this added potassium in a form less soluble in limed than in unlimed soil. Usually the K that is retained by the soil against leaching is greater percentagewise for a light addition, although the actual retention may be larger for heavier rates of K additions.

In another experiment with three soils of divergent characteristics, the additions of K were made in each of the three soluble forms —nitrate, chloride, and sulphate—with and without limestone and dolomite.

The data of Table 4 show the amounts of potash, K_2, recovered from 10 annual additions of 200 pounds of K_2O applied in each of the three forms to the Jackson or Calhoun soil, unlimed and limed with limestone and

TABLE 3—AMOUNTS OF K LEACHED—LBS. PER 2,000,000 LBS. OF BROWN SILTY CLAY LOAM*

Soil only	Soil + K_2SO_4	Soil + K_2SO_4 + limestone	Soil + K_2SO_4 + dolomite
Outgo from 10 annual additions of 229 lbs. of K			
528	2102	1978	1971
Outgo from 10 annual additions of 458 lbs. of K			
528	3794	3682	3660

* This soil was characterized by an unusually high content of exchangeable K, as a result of having been in sod for many years.

TABLE 4—AMOUNTS OF K_2O LEACHED FROM 10 ANNUAL ADDITIONS OF 200 LBS. OF K_2O TO AN ALKALINE JACKSON (CALHOUN) SOIL

	Lbs.	Net recovery Per cent
Soil only	76	......
Soil + KNO_3	1288	61
Soil + KNO_3 + limestone	1190	56
Soil + KNO_3 + dolomite	1236	58
Soil + KCL	1220	58
Soil + KCL + limestone	1195	56
Soil + KCL + dolomite	1218	57
Soil + K_2SO_4	1271	60
Soil + K_2SO_4 + limestone	1237	58
Soil + K_2SO_4 + dolomite	1235	58

with dolomite at the constant rate of two tons of $CaCO_3$. The single liming treatment was a full-depth incorporation at the beginning of the experiment. This particular soil is naturally mildly alkaline, although it is neither a calcareous soil nor one high in natural supplies of non-carbonate calcium. The liming, therefore, did not bring about a condition or soil reaction opposite to that which prevailed in the unlimed soil at the beginning of the experiment. In each case, the amount of potassium leached from the unlimed soil exceeded that leached from its corresponding unit that had been limed. Nevertheless, the effect of the liming treatment upon potassim retention was not so extensive, nor so definite, as that registered by the liming treatments upon acidic soils. This will be seen from the values given for the net recoveries from the three potassium salts on two acidic soils of the same experiment, in relation to the 10-year recoveries from those units that were limed with either limestone or dolomite at the beginning of the experiment.

TABLE 5—AMOUNTS OF K_2O LEACHED FROM 10 ANNUAL ADDITIONS OF 200 LBS. OF K_2O TO HARTSELLS (CROSSVILLE) FINE SANDY LOAM

	Lbs.	Net recovery Per cent
Soil only	170	......
Soil + KNO_3	1213	52
Soil + KNO_3 + limestone	864	35
Soil + KNO_3 + dolomite	952	39
Soil + KCl	1246	54
Soil + KCl + limestone	946	39
Soil + KCl + dolomite	1008	42
Soil + K_2SO_4	1331	58
Soil + K_2SO_4 + limestone	1009	42
Soil + K_2SO_4 + dolomite	1086	46

The potassium recoveries shown in Table 5 were obtained from the Crossville or Hartsells fine sandy loam, in parallel with the results shown in Tables 4 and 6. The Hartsells soil is decidedly acidic and the additions of the limestone and dolomite exerted a substantial repressive effect upon the outgo of the potassium added as either nitrate, chloride, or sulphate.

The data in Table 6 were obtained from a Cumberland silt loam, in parallel with the results from the other two soils, as given in Tables 4 and 5.

In the case of the Cumberland silt loam of Table 6, however, an additional multiple-rate potassium treatment was included in the experiment, the sulphate of potassium treatment being used at a rate four times the standard rate of 200 pounds of K_2O per annum for a 10-year period. The soil had ceased to retain any appreciable quantity of potassium after seven of the 4-fold treatments, and the additions then were discontinued. In every comparison for each of the three potassic salts, the limestone and the dolomite served to diminish the outgo of the added potassium below the amount leached from the corresponding addition to the unlimed soil.

The percentage retention was greater for the lighter rates of potash addition. Apparently, the marked increase in the concentration of potassium salts resultant from the 4-fold treatment overcame to some extent the capacity of the light liming treatments to diminish the leaching of potassium.

TABLE 6—AMOUNTS OF K_2O LEACHED FROM 10 ANNUAL ADDITIONS OF 200 LBS. OF K_2O TO CUMBERLAND SILT LOAM

	Lbs.	Net recovery Per cent
Soil only	221	......
Soil + KNO_3	1507	64
Soil + KNO_3 + limestone	980	49
Soil + KNO_3 + dolomite	1283	53
Soil + KCL	1526	65
Soil + KCL + limestone	1526	52
Soil + KCL + dolomite	1177	59
Soil + K_2SO_4	1652	72
Soil + K_2SO_4 + limestone	1338	56
Soil + K_2SO_4 + dolomite	1389	58
Soil + $K_2SO_4 \times 4$	5710	98
Scil + $K_2SO_4 \times 4$ + limestone	5331	91
Soil + $K_2SO_4 \times 4$ + dolomite	5507	94

In the foregoing experiments, the several liming materials were used at rational economic rates. Additional experiments have been conducted with a Cumberland silt loam over a 26-year period, during which it has been possible to register the effects of incorporations of seven liming materials at heavy rates. These seven materials were burnt lime, magnesia, precipitated calcium carbonate (corresponding to marl), magnesium carbonate, 100-mesh limestone, 100-mesh dolomite, and 100-mesh magnesite (the mineral carbonate of magnesium). Each of these materials was used at three rates, 8-ton, 32-ton, and 100-ton equivalences of CaO, or

(Continued on page 24)

Distribution and Pricing of Amonium Nitrate Studied

A PROPOSAL that a single agency of the Government take over the handling of ammonia nitrate in the East, including that produced by the TVA, the ordnance plants of the army and that being imported from Canada, as a solution of an almost impossible situation that has developed in the distribution of the material, is under consideration by War Food Administrator Marvin Jones, it was learned December 8th.

The problem arises out of the varying costs of transporting the ammonia nitrate, which is to perform an important part in the overall fertilizer distribution program in the production of next year's food and feed crops, from the point of production to the areas of consumption. Because prices are on an f. o. b. point of production basis, dealers are finding it impossible to figure their prices with any degree of certainty for as little as even a week ahead.

Prices presently are fixed at $47.50 a ton, f. o. b. production plant, to which is added the cost of transportation to the dealers. Under normal circumstances this would not be an unsatisfactory method of pricing the material since all dealers in a given area would receive their supplies from approximately the same point and the transportation costs would be approximately the same. In this instance, however, the ordnance plants are scattered in many different sections of the country, some of them quite remote from the consuming area, which necessarily means varying freight charges.

The situation probably could be leveled out, it is explained, if it were possible for the War Production Board, in allocating the material, to so distribute supplies as to treat all dealers alike. For example, that produced by TVA to be allocated only among dealers in a given area reasonably adjacent to the TVA; that imported from Canada to the dealers in the North and that produced by the ordnance plants in the South to the dealers in the South.

However, due to the fact that production by the ordnance plants and imports from Canada are variable, being subject to changes as military demands for explosives might dictate, WPB has not found it practical to follow a planned pattern of allocations. Allocations must constantly be shifted from one point of production to another. This all adds up to a situation something like this:

Dealer A in Boomtown, S. C., will have received a shipment of ammonia nitrate from the TVA on which freight charges amounted to only $3 a ton. Dealer B, just across the street, might have received a shipment that originated in Canada on which a freight charge of $10 is due. Next week, dealer A may find that his next shipment will come from one of the ordnance plants, and the freight charge may be $5 or $8.

Officials recognize that such conditions cannot be permitted to continue. Not only is it making it impossible for the dealers to operate in a satisfactory manner, but such a situation will naturally arouse farmer complaints and bring about another congressional investigation of the handling of the fertilizer program. Officials already are facing difficulties in overcoming farmer reluctance to use ammonium nitrate as a fertilizer because of the unsatisfactory condition of the original material distributed to the farmers.

There are three possible solutions of the problem said to be under consideration by Mr. Jones:

1. Have all the production of ammonia nitrate, including that imported from Canada, handled and distributed by Defense Supplies Corporation under an arrangement equalizing the differing freight costs which would mean offsetting the higher freight cost against the lower freight cost and making the delivered price to all dealers the same.

2. Have it handled in the same manner by TVA.

3. Fix a specific price ceiling applicable to all dealers.

Officials appear to favor either the first or second methods of approach to the problem. The third proposal is objectionable because of the difficulties of OPA in ascertaining cost figures and the likelihood that any price ceiling established within reason might mean heavy losses to some dealers or windfalls to others, depending upon the point of origin of the material.

In fixing the net price of $47.50 a ton for the ordnance material, the original aim was to establish some kind of a relationship between the price of ammonium nitrate and ammonium sulphate. But because of the allocation problems and the resultant varying of freight costs, this relationship has broken down.

The price of ammonia nitrate in the West is currently being quoted at around $70 a ton. While this would appear to be high in comparison to the price in the East, OPA officials and others in the Government do not appear to be greatly disturbed. They recognize that there is a variance in labor costs as between the East and West and also that there is a difference in freight costs, as well as longer hauls.

There is a probability that this price may be reduced somewhat at an early date. It is understood that presently the ammonia nitrate is moving under the chemical freight rates and steps are now being taken to have it freighted under the fertilizer rate. This would reduce the cost from $6 to $8 a ton.

With respect to the net price of $47.50 a ton to the army on its ordnance ammonium nitrate, however, the OPA has indicated its desire to learn more about how that figure was arrived at. And also how the TVA arrived at its price of $49 a ton for the ammonium nitrate it produces. The $47.50 price to the army, plus the $1.50 per ton charge to TVA for handling the ordnance product, figures out to the same price being charged by TVA for its ammonium nitrate.

Officials find it difficult to understand how this should come about since the army must pay freight charges on shipping its raw material to the crystallization plants, while the TVA does not have to meet such charges since its production is carried on all under the same roof.

Final Cotton Crop Estimate

The United States cotton crop is now estimated at 11,478,000 bales, 10 per cent less than last year, with an average of 252 pounds per acre, 20 pounds below the average for last year but well above the average for the previous ten years. Production of American Egyptian cotton is estimated at 68,300 bales and of Sea Island cotton at 300 bales, both being reductions from last year. Production of cottonseed is estimated at 5,116,000 tons, or 600,000 tons less than last year, according to the December 1 Crop Report.

Fertilizer Branch of WFA Reorganized

A reorganization of the Chemicals and Fertilizers Branch of the War Food Administration that has been under way since July 1st to bring about a closer knit organization for handling the chemical problems of the farm program, has been virtually completed with the appointment of Dr. G. F. MacLeod as chief of the Chemicals Division.

In a move to streamline the setup to deal more promptly and efficiently with the big problems of food production brought on by the war, the Chemicals and Fertilizers Branch was made a part of the Office of Materials and Facilities of the War Food Administration at the beginning of the current fiscal year.

P. H. Groggins, who headed up the branch in the old setup, is still the chief of the branch in the new organization, reporting on the operations of his branch directly to J. W. Millard, chief of the Office of Materials and Facilities.

The reorganization has divided up the branch into two main divisions and five sections, with each assigned some particular line of functioning in the handling of problems in the field of chemicals and fertilizers.

The two divisions are the Chemicals Division and the Fertilizers Division, the former headed by Dr. MacLeod, on leave of absence from the University of California, who took office on December 1st, and the latter by M. J. Derrick, who was with the Indiana Farm Bureau before joining the Government.

Under the Chemicals Division are the Economic Poisons Orders Section, with C. C. Hamilton as chief, who formerly was with the New Jersey Experimental Station; the Economic Poisons Requirements Section, which is to be headed by Dr. MacLeod for the time being; and the Miscellaneous Chemicals Section, under the direction of J. M. Schaffer, who came to the branch from the War Production Board.

The Fertilizers Division has two sections under its jurisdiction:—the Fertilizers Orders Section, headed by W. E. Lakin, an industry man formerly with the WPB, and the Fertilizers Requirements Section, with W. F. Watkins as chief. Mr. Watkins transferred to the branch from the Bureau of Agricultural Economics.

The Field Services Section, which reports directly to Mr. Groggins in the new setup, is under the direction of L. G. Porter, who has been in Government service for a number of years.

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Principal Articles in This Issue

Farmers Urged to Accept Immediate Delivery of Fertilizer

Acceptance by farmers of immediate delivery of fertilizer—to avoid acute labor, storage, and transportation shortages next spring—has been urged by the Fertilizer Industry Advisory Committee in a meeting with officials of the War Food Administration, in Washington, D. C.

The committee also recommended a voluntary 3-point plan to conserve transportation used by the fertilizer industry, and proposed that 200,000 tons of ammonium nitrate be set aside in 1944 for certain crops in specified areas. WFA officials said that early consideration would be given to the recommendations and that any actions taken would be for the purpose of aiding maximum food production in 1944.

In urging farmers to accept immediate delivery of fertilizer, the committee said if there is to be any relief next spring, when the impact of labor, storage, and transportation shortages will be the greatest, it must come in the next few weeks. This is especially true of the heavy-using areas of the South, the committee added.

The industry advisory group recommended that 100,000 tons of ammonium nitrate, if available, be set aside, under FPO-5 (Fertilizer), by regions and states for use in the production of forage and feed crops. These crops are not listed as high priority fertilizer crops under FPO-5. However, the committee said that heavier than usual fertilization would help increase production of these urgently needed feed crops.

It was estimated by the committee that if 1943–44 sales of mixed fertilizer total 8,000,000 tons, it will require 290,000 tons of nitrogen, if the average nitrogen content of 1941 continues in effect. This would compare with approximately 200,000 tons used annually in mixed fertilizer in the 1941–42 and 1942–43 crop years.

The committee felt that the supply of nitrogen is sufficiently large to justify recommendation and manufacture of as high nitrogen grades as are permitted in FPO-5. It estimated that the potential supply of nitrogen available for use in mixed fertilizers, during 1944, is about 350,000 tons of nitrogen, including material from organic sources.

The voluntary 3-point plan recommended to conserve transportation in the fertilizer industry follows:

1. Transfer as much fertilizer tonnage as is

practical from truck hauls to railroad movement.

2. Load railroad cars to maximum practical capacity.

3. Reduce truck deliveries from fertilizer plants to a minimum where the truck is loaded only one way.

The committee expressed the belief that the maximum efficiency in the usage of trucks and railroad cars by the fertilizer industry can be accomplished best through personal contacts by fertilizer manufacturers with dealers and agents.

The Transportation Conservation Division of WFA urged the fertilizer industry to avoid the use of excessively circuitous routes, and to eliminate wasteful transportation.

A representative of WFA's Office of Labor told the committee that in cases where the Office of Labor can be of any assistance it will cooperate in obtaining war prisoners to relieve the manpower shortage in the fertilizer industry.

Dr. Oswald Schreiner Retires

Dr. Oswald Schreiner, for many years in charge of the former Division of Soil Fertility Investigations in the U. S. Department of Agriculture, is retiring on December 31st, after more than 40 years of service, with many honors for his research accomplishments.

One hundred and twenty letters from his professional associates and friends from all over the country have been assembled and bound and will be presented to him on December 20th, at a meeting in his honor at the Department's Plant Industry Station, Beltsville, Maryland.

Coming to Baltimore from Nassau, Germany, in 1883 with his parents, when he was 8 years old, he became an honor student in pharmacy and chemistry at the Maryland College of Pharmacy and later studied at the Johns Hopkins University and the University of Wisconsin. He did teaching and research at Wisconsin and received his B.S., M.S., and Ph.D. degrees there.

Dr. Schreiner was appointed expert in physical chemistry investigations in the former Bureau of Soils of the Department of Agriculture in 1902, and during his service in Government soils investigations has contributed greatly to advances in this field—lecturing and doing advisory work as well as research. He was chairman of the American Organizing Committee of the First International Soil Science Congress, which was held in this country in 1927, and took an active part in many other international conferences on soils, chemistry, and crop problems.

Dr. Schreiner and his associates in the Division of Soil Fertility Investigations introduced many research advancements, including, among others, the "triangle" of fertilizer-ratio system; the Schreiner colorimeter and other methods for determining water-soluble plant-food constituents; facts on the relationship of the so-called rarer elements to health of plants; fundamental facts on the effects of soil organic matter in promoting or inhibiting plant growth; and the discovery and study of more than 50 new soils organic compounds which changed fundamental conceptions of the part played by organic matter in crop production.

Dr. Schreiner is a past president of the Association of Official Agricultural Chemists and is a Fellow of the American Society of Agronomy. He is a member of the Cosmos Club, the American Chemical Society, Soil Science Society of America, International Soil Science Society, Washington Academy of Science, and International Society of Sugar Cane Technologists.

Some Changes in Superphosphate Ceilings

A ceiling price of 66 cents per unit of available phosphoric acid content per ton for sales of superphosphate run-of-pile, f. o. b. cars at Hagerstown, Md., was established on December 8th, by the Office of Price Administration.

This price is in line with the maximum price at Baltimore, the nearest producing point, in view of the freight differentials on raw materials. Production of superphosphate only recently was begun at Hagerstown.

At the same time, the ceiling price of superphosphate of Shreveport, La., was increased 2½ cents per unit. This advance is the minimum considered necessary to insure production at Shreveport, which, the War Food Administration has informed OPA, is essential to the war effort. The newly established price is not higher than the level of October 1 to 15, 1941.

OPA also increased the maximum price of triple superphosphate produced at Siglo, Tenn., to the same basis as was established earlier at Wales, Tenn. This increase from 70 to 74 cents was necessary, OPA said, to cover increased cost to the producer, who now is required to use Florida phosphate rock in his plants instead of high grade Tennessee rock, which no longer is available.

Obituaries

EDWARD L. ROBINS

Edward L. Robins, associated with the fertilizer industry for fifty years, died of a heart attack December 10th in Shreveport, La. He was seventy-three years of age.

Born in Guntown, Miss., in 1870, Mr. Robins graduated from Mississippi State College in 1892 and received his master's degree there in 1895. From 1893 to 1898 he was assistant State chemist of Mississippi, resigning in 1898 to become chemist for the Meridan Fertilizer Factory. He became president of the company in 1919 and held that position until 1933.

Mr. Robins served the Southern Fertilizer Association in many capacities, was elected president in 1923 and served until the Southern and National Associations were consolidated in 1925, being one of the incorporators of the new association, its first vice-president, from 1925 to 1927, and its second president, from 1927 to 1929. He also served many years as a director and as district chairman. During the code period, 1933 to 1935, Mr. Robins served as secretary of zones 8 and 9, and since 1936 has been secretary of the Southwest Soil Improvement Ccmmittee.

WILL BENTON NORRIS

Will Benton Norris, president and general manager of The Norris Fertilizer Company, Rushville, Indiana, died of a heart attack at his home on November 30th.

Mr. Norris had spent thirty-three years in the fertilizer industry. In fact, he represented the third generation of his family in the fertilizer business. He founded The Norris Fertilizer Company in 1923 and had operated it successfully for 20 years. He was energetic, able, loyal to his friends and business associates. He was a long-time member of the National Fertilizer Association, and had served as a member of the Board of Directors since 1933. He was also a member of the Middle West Soil Improvement Committee.

He is survived by his wife, his mother, two sisters, and two brothers.

GEORGE N. PEEK

American agriculture and the fertilizer industry lost an outstanding and loyal friend Friday, December 17th, when George N. Peek passed away suddenly at his home at Rancho Santa Fe, California, from cerebral hemorrhage. Although he had not been feeling well recently, he was active to the last.

Mr. Peek has been a dynamic force in American agriculture since the period of the World War. It was his vision, energy, and leadership that brought about courageous and constructive agricultural legislation during the decade of the 30's, and resulted in his selection as the senior executive officer of the Agricultural Adjustment Administration in 1933. During World War I Mr. Peek was commissioner of finished products of the War Industries Board and was awarded the Distinguished Service Medal for his work. France made him a member of the Legion of Honor, and both Belgium and Italy also decorated him for his war services.

Mr. Peek's business life was spent in the agricultural implement industry, first with Deer and Company and then as president of the Moline Plow Company in which Gen. Hugh S. Johnson was associated with him. Since 1923 Mr. Peek has devoted his whole time to public effort to improve the economic status of American agriculture. After his services in the Agricultural Adjustment Administration, he was appointed president of the Export-Import Bank and was named special adviser to the President on foreign trade.

FERTILIZER MATERIALS MARKET

NEW YORK

Increased Supply of Ammonium Nitrate but Change in Distribution Methods Expected. Potash Will Be Relatively Scarce for Several Years. Labor Shortage May Hinder Production of Phosphate Rock and Superphosphate.

Exclusive Correspondence to "The American Fertilizer"

NEW YORK, December 15, 1943.

Sulphate of Ammonia

Regular shipments continue to be made against material previously allocated.

Ammonium Nitrate

With the increased supply of this material the matter of distribution is causing some concern. We understand there is some disposition to correct present methods of distribution and probably booking on delivered price might help. Buyers are not taking kindly to this material which makes distribution in larger quantities more difficult.

Nitrate of Soda

This material is being delivered regularly against previous allocations.

Potash

There is no indication that any additional allocations will be made for delivery during the second period. At a recent meeting in Washington it was quite generally agreed that demand for potash for the next few years would undoubtedly be considerably in excess of possible production. Deliveries are being made regularly, with buyers requesting rush shipments to particular destinations, proving lack of stock piles and scarcity of material.

Superphosphate

Demand continues and even with increased production material is moving about as rapidly as it can be made. If supply of sulphuric acid is available and plants are not hindered by manpower shortage, it is expected that all plants will operate in full capacity.

Phosphate Rock

Production continues in large volume with rock being moved steadily, due to the demand for superphosphates. In the operation of the mines the question of manpower is all-important and the rock people are fearful that their output may be curtailed due to the lack of labor.

BALTIMORE

Burlap Fertilizer Bags Permitted If Other Kinds Unavailable. Material Prices Remain Steady. Most Organics Going to Feed Trade.

Exclusive Correspondence to "The American Fertilizer"

BALTIMORE, December 14, 1943.

Business in fertilizer materials continues along more or less routine lines, but there has been an easing up in restrictions surrounding the use of burlap for fertilizer bags. The War Production Board is permitting fertilizer manufacturers to use burlap bags where they are experiencing difficulty in obtaining cotton and paper bags for the packaging of their products, upon proof by the applicant that he has been unsuccessful in obtaining less critical materials.

Ammoniates.—There is very little change in the market on domestic tankage and blood, as the scarcity and high prices have restricted the use of both as far as fertilizer manufacturers are concerned.

Castor Pomace.—The position of this commodity remains the same, with no offerings on the market at present. The ceiling price is still $2.90 per unit of ammonia ($3.52½ per unit N), f. o. b. producer's works.

Sulphate of Ammonia.—The situation is unchanged since last report.

Nitrate of Soda.—Shipments are still being made against allocated orders.

Superphosphate.—The market remains the same at 64 cents per unit for run-of-pile, f. o. b. seller's works, Baltimore, and shipments being made against contracts previously booked.

Fish Meal.—No activity is looked for in this commodity until spring when fishing on the Chesapeake Bay is again resumed.

Potash.—Fertilizer manufacturers are still receiving shipments under allocation, and the demand remains steady.

Bone Meal.—There is very little domestic material obtainable for fertilizer purposes, and what sales were made were to the feed trade.

Bags.—With the lifting of restrictions in the use of burlap for fertilizer bags under certain conditions, by the WPB, more activity is looked for from now on.

PHILADELPHIA

Production of Fertilizer Materials and of Mixed Fertilizers Increasing. No Cut in Sulphate of Ammonia Allocations. Fertilizer Organics Scarce.

Exclusive Correspondence to "The American Fertilizer"

PHILADELPHIA, December 13, 1943.

The chief interest since our last report seems to have been centered on production figures for ammonium sulphate, mixed fertilizers, superphosphate, and ammonium nitrate. All seem to be in heavier production and, in the case of the mixed goods, it is hoped that the farmers will take deliveries as quickly as they can, to relieve storage space so as to permit continuance of factory operations.

Ammoniates.—Not much change since our last report. The inorganic materials continue under allocation, and the organic products are scarce to almost unobtainable.

Sulphate of Ammonia.—Allocations still are made on 100 per cent basis, and production holding well.

Nitrate of Soda.—Negotiations have been reported for the acquisition of Chilean material.

Superphosphate.—The production rate apparently is holding up, and demand is not far behind.

Bone Meals.—Still scarce and in demand.

Potash.—The production apparently is holding a good rate, and shipments to allocated users are in steady volume.

CHARLESTON

Fertilizer Organics Scarce. Allocation of Cottonseed Meal May Be Withdrawn. No Additional Potash to be Allocated This Winter.

Exclusive Correspondence to "The American Fertilizer"

CHARLESTON, December 13, 1943.

Fertilizer tag sales continue to show a large increase for the fall over the previous years. While this is not a definite indication of the actual tonnage shipped this fall, it is true that the movement is heavier than previous years.

Organics.—There are still no additional offerings of processed tankage and the last information we saw indicated that permission which had been given to fertilizer manufacturers to buy cottonseed meal would be withdrawn.

Castor Pomace.—All producers seem to be sold up for some time to come, and no offerings are being made.

Potash.—An announcement has just been made that fertilizer manufacturers cannot expect any additional general allocation of potash during the second period ending March 31st.

CHICAGO

Fertilizer Organics Market Dull. Bone Meals Scarce for Fertilizer Use. Feed Market Still a Sellers' Market.

Exclusive Correspondence to "The American Fertilizer"

CHICAGO, December 13, 1943.

Western organic business is still on the dull side, with offerings woefully lacking. Only such tonnage which is allocated has made its appearance, and that seems far below buyers' requirements.

Steamed and raw bone meals for fertilizer remain scarce, all productions being used in the feed market.

The heavy receipts of livestock have apparently not materially relieved the feeding situation, demand being still beyond mixers' ability to fully supply.

With such situations, ceiling prices are easily maintained.

High grade ground fertilizer tankage, $3.85 to $4.00 ($4.68 to $4.86 per unit N) and 10 cents; standard grades crushed feeding tankage, $5.53 per unit ammonia ($6.72 per unit N); blood, $5.38 ($6.54 per unit N); dry rendered tankage, $1.21 per unit of protein, Chicago basis.

TENNESSEE PHOSPHATE

Rock Production Continuing at Midsummer Peak. Production for 1943 May Reach 1½ Million Tons

Exclusive Correspondence to "The American Fertilizer"

COLUMBIA, TENN., December 13, 1943.

During the past thirty days the situation in the Tennessee phosphate field has undergone little change. The shipment of phosphate rock into all consuming channels has continued with midsummer activity, especially of ground phosphate rock for direct application by farmers. The volume of orders has continually grown faster than shipments can be made, largely because the AAA has extended to December 31st the date by which phosphate must be applied to earn benefit payments for 1943 program.

Among recent visitors to the Tennessee Field was a Southern Indiana farmer who, at eighty, still drives his own tractor and does the plowing on his 165-acre farm. He says he began using rock phosphate 38 years ago and applies 1000 lb. per acre every ten years but continues to apply every year 100 lb. per acre of good commercial fertilizer at planting time, so he gets all the stimulating effect and his land is better now than it was thirty years ago, instead of being depleted as so many acres have become.

From the best estimates that can now be made, it is expected that the total shipments, combined with local consumption, of phosphate rock for 1943, will considerably exceed 1¼ million tons, with possibility of 1½ million. The ground rock shipments for direct application out of Tennessee will exceed 200,000 tons, the all-time top, while Florida is reported to be doing almost as much in this channel as Tennessee.

The largest single state in the consumption of ground rock for direct application is still Illinois, where such use has received University encouragement and support for over forty-five years. The use in other states outside of Illinois now exceeds the volume in Illinois, and bids fair to soon go far ahead.

It is gratifying to the pioneers of the ground rock business in Tennessee who started over 47 years ago with an output of less than 2000 tons per year, to see this channel now assume so significant a position in the phosphate industry.

All plants that have grinding capacity both in Florida and Tennessee are reported to have more orders than can be filled.

DETERMINATION OF POTASH IN FERTILIZERS OR BASE GOODS

(Continued from page 6)

Florida land pebble phosphate contains 0.19 per cent K_2O (average of 11 analyses), Tennessee brown rock phosphate 0.435 per cent (average of 6 analyses), and Idaho phosphate 0.44 per cent (average of 3 analyses).

While the potash is originally present mainly as silicates, a small amount is probably decomposed by the action of fluorine in the mixing pan and during subsequent curing.

Literature Cited

(1) Jacob, K. D., Hill, W. L., Marshall, H. L., and Reynolds, D. S., U. S. Dept. Agr., Tech. Bull. 364 (1933).

(2) Scott, W. W., "Standard Methods of Chemical Analysis," 4th ed., p. 410, New York, D. Van Nostrand Co., 1925.

November Tax Tag Sales

Reflecting the early buying of next spring's fertilizer requirements, November tax tag sales rose to 463,000 tons, an unusually high figure for November. Sales were 85 per cent larger than a year ago and more than double November, 1941, sales.

Total sales in the 17 reporting States in the first eleven months of the year amounted to 6,958,000 tons, an increase of 1,119,000 tons or 19 per cent over the corresponding period of last year. Practically all of the increase took place in the last five months; sales in the first six months were almost the same this year as last. The sharp increase during the fall season—57 per cent over last year—was due in large part to early buying for next season, and does not represent a comparable increase in actual fall consumption.

Sales in all of the reporting States, except Indiana, have been substantially greater this year than last. Increases in the South range from 10 per cent in Virginia to 117 per cent in Oklahoma.

McNutt Answers Requests for Greater Fertilizer Labor Supply

At the October meeting of the Board of Directors of the National Fertilizer Association, a resolution was adopted requesting relief from the labor shortage in the fertilizer industry through action by interested government agencies. In a letter dated November 15th, Paul V. McNutt, Chairman of the Federal Security Administration, takes up the questions submitted by the Board and comments on them, as follows:

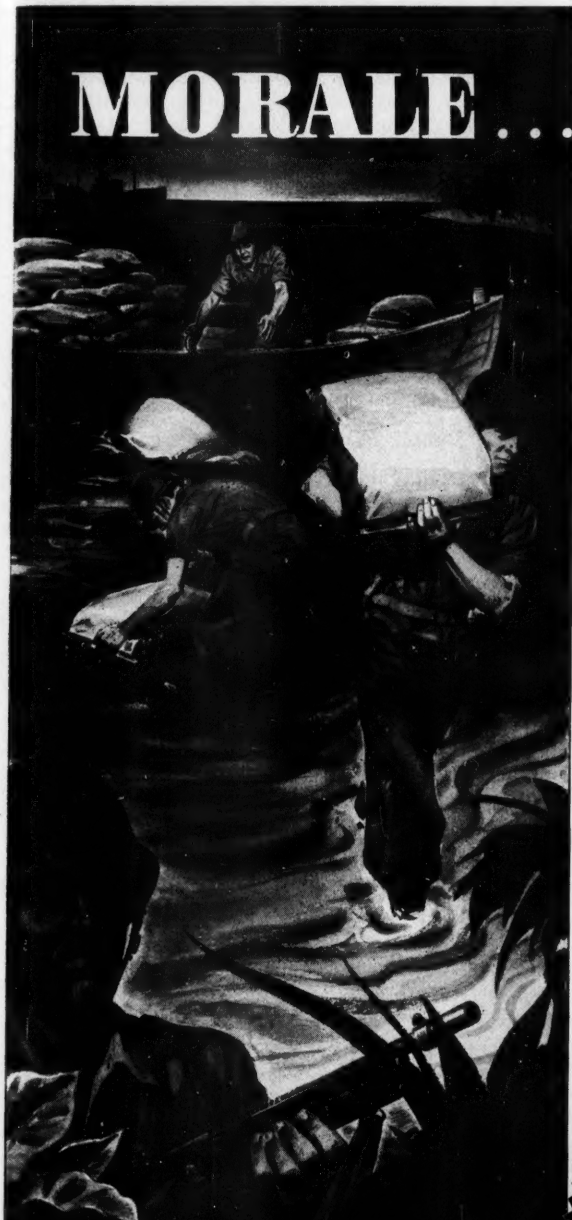
1. That war prisoners be made available for work in fertilizer plants wherever possible.

In those fertilizer producing areas where war prisoner camps are located, arrangements for obtaining such workers may be made through local offices of the United States Employment Service.

In several areas, where employers have so requested, war prisoners are now engaged in occupations connected with fertilizer production. Some of these areas report that prisoners are not being fully employed, due to the failure of employers to submit requests for

FERTILIZER TAX TAG SALES

State	November 1943 Tons	November 1942 Tons	November 1941 Tons	% 1942	January–November 1943 Tons	January–November 1942 Tons	January–November 1941 Tons
Virginia	13,350	10,175	9,300	110	448,081	405,713	393,239
North Carolina	77,631	29,687	39,079	112	1,272,496	1,136,447	1,079,040
South Carolina	58,680	27,180	13,860	122	816,903	667,144	698,322
Georgia	59,240	37,697	13,992	123	995,977	813,008	778,366
Florida	102,480	67,270	70,187	127	731,685	577,909	570,236
Alabama	54,250	1,050	1,650	123	698,050	565,250	573,400
Mississippi	29,831	29,588	22,675	136	453,045	334,207	355,467
Tennessee	7,219	100	910	131	226,485	173,286	141,351
Arkansas	8,960	5,050	1,350	126	174,665	138,208	115,550
Louisiana	9,900	7,950	10,300	118	193,268	163,666	174,810
Texas	8,250	5,320	4,275	131	163,400	124,604	135,576
Oklahoma	900	0	0	217	18,988	8,747	10,950
Total South	430,691	221,067	187,578	121	6,193,043	5,108,189	5,026,307
Indiana	12,290	25,864	1,250	94	396,080	421,891	336,110
Illinois	14,886	750	1,012	127	103,066	80,839	62,567
Kentucky	4,681	1,845	0	109	159,387	145,932	121,976
Missouri	156	25	115	127	89,717	70,822	86,849
Kansas	0	0	0	143	16,279	11,415	19,011
Total Midwest	32,013	28,484	2,377	105	764,529	730,899	626,513
Grand Total	462,704	249,551	189,955	119	6,957,572	5,839,088	5,652,820



MORALE . . . *in Bags*

Morale among fighting men depends upon full mess kits, and Uncle Sam spares no effort to see that his warriors on land and sea are the best fed in the world.

Getting this all important food to the men on our far-flung fronts in a sound, wholesome condition is just as important as "keeping their powder dry." It's a task that calls for wide experience and know-how . . . a task the bag industry has taken in its stride.

In the 22 Bemis mills and factories more than 8,000 employees have made millions of bags to protect and transport food over land and sea, from farm and factory to fighting men. We like to think this our contribution to morale for Victory. In addition to this important work, we still find time to supply industry and agriculture with bags for other war materials and essential civilian goods.

Fertilizer Industry Cuts Costs and Reduces Losses with Bemis Multiwall Bags

Bemis Multiwall Paper Bags for fertilizer are economical, sift-proof, one-trip containers. Bemis patented self-forming gussets make for easier filling and closing. The extra strength of these rugged bags minimizes breakage on production lines. Brilliant Bemis printing makes brands stand out.

Let us work with you in supplying packages for your war or civilian production. From the bags themselves to their filling, closing, shipping and storing, our staff of experts can help you. If you have a packaging problem . . . present or future . . . let's talk it over.

Among the bags produced for war service by Bemis are Multiwall Paper Bags slipped over cloth bags for foods to be shipped overseas. These packages are especially designed so they can be tossed into the water and carried ashore without damage to contents.

BEMIS BAGS

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BETTER BAGS FOR 85 YEARS

their services to United States Employment Service local offices. It is essential that employers desiring services of war prisoners submit their requests to their nearest United States Employment Service office.

2. That members of the armed forces be made available for work in fertilizer plants wherever possible.

The War Department has looked with disfavor upon any request for expansion of present procedure to permit employment of troops (groups of soldiers) in non-agricultural activity. It is felt that such employment would interfere with the training designed to prepare these men for their major objective—fighting the enemy.

3. That certain key men in the fertilizer industry who have been drafted into the armed forces be released to the industry for the duration of the war.

In accordance with procedure established by the War Department, certain key men, upon request from their previous employers, may be released from service provided they have not left the continental United States. Normally, such a key worker would be released for a limited time only, or for such time as may be required to train another worker to replace him in that occupation. The local United States Employment Service offices are prepared to inform employers as to the nature of information which must be submitted to the War Department by the employer who wishes to request release of a soldier.

4. That the United States Employment Service and War Manpower Commission cooperate more fully with employers of the fertilizer industry in obtaining labor for fertilizer plants.

The War Manpower Commission and local United States Employment Service office facilities are available to the fertilizer industry as they are for any other activity. The effectiveness of cooperation can be enhanced by mutual understanding of the problems involved in recruiting labor under extraordinary labor market conditions. No specific instances of failure of the United States Employment Service to cooperate with the fertilizer industry had been called to our attention; on the contrary, we have evidence of many instances where special efforts have been extended in behalf of fertilizer plants. Under vastly depleted labor market conditions, it is impossible to meet total labor demands of all employers who, in most instances, are desirous of increasing production in keeping with wartime needs. However, the local United States Employment Service offices are attempting to assist in the equitable distribution of labor, taking into consideration the essentiality of the industry to military and civilian needs. In many cases wages, hours, and other working conditions, beyond the control of the United States Employment Service, adversely affect recruitment efforts. We urge, strongly, that fertilizer plant managers make known their requirements to the United States Employment Service local offices as far as possible in advance of the actual need for the workers, in order that a cooperative program may be developed to assist in relieving prospective shortages.

5. That a freeze be granted for all employees of fertilizer and raw materials manufacturers, with draft exemption for all such employees for the duration of the war.

Blanket deferment or draft exemption for all employees in any industry can be accomplished through Congressional action, only. We believe you will agree that the recruitment of an effective fighting force of 10 or 11 million men could not be accomplished if all workers in even the most essential industries were granted permanent deferment status.

The War Manpower Commission, through the Selective Service System, has developed procedure which permits agricultural workers with a deferment status to accept employment in seasonal non-agricultural activities, including fertilizer production, without jeopardizing their deferment status. For instance, farm workers with a deferred status, who may be terminating their seasonal employment, may accept work in a fertilizer plant during the winter months and still retain their deferred classification. In view of the importance of fertilizer to the crop production program, it seems only logical that farmers and farm workers should be considerably interested in maximum production of this item.

See Page 4

International Minerals and Chemical Corp. Receives "E" Award

Ceremonies were held in Austin, Tex., November 30th, for the presentation of the Army-Navy "E" to the employees of the magnesium division of International Minerals & Chemical Corporation, whose general offices are in Chicago. Lt. Col. Arthur T. Crossley, Office of the Chief, Chemical Warfare Service, Washington, D. C., made the presentation of the "E" award. Commander W. P. Kellogg, U. S. N. Executive Officer, Inspector, Naval Material, Houston, Texas, presented the "E" pins to employees.

Burley Tobacco Marketing Quota

Of 123,559 farmers voting October 23rd in a Burley marketing quota referendum, 92.8 per cent favored quotas for three years, according to the official tabulation by the War Food Administration. Ballots were cast in 13 States.

Quotas for one year only were favored by 2.1 per cent of the voters and quotas were opposed by 5.1 per cent of those voting. Kentucky voters, numbering 82,381, were 94.6 per cent in favor of quotas for a three-year period beginning October 1, 1944.

A national marketing quota for Burley tobacco of 404,460,000 pounds for the 1944–45 marketing year will be in effect, since more than two-thirds of those voting approved. This quota was proclaimed on October 6th.

The WFA had previously announced that the 1944 national marketing quota and State and farm acreage allotments for both Burley and flue-cured tobacco would be 20 per cent higher than in 1943, with provisions for adjustments. Flue-cured tobacco growers approved continuance of marketing quotas in a referendum held July 24th, by a 7 to 1 vote.

Georgia Fertilizer Recommendations

On land of low fertility, or where grain crops are to be used for grazing, use 200 to 350 pounds per acre of 2–12–6, 3–9–6, or 4–12–4 at planting time. Then top-dress with 16 to 32 pounds of nitrogen early in the spring. On soils of fair fertility use 200 to 300 pounds of 0–14–7 or 0–14–10 or equivalent. For winter legumes, use 200 to 400 pounds per acre of 18 per cent superphosphate, or its equivalent; and where grains are seeded with the legumes add the equivalent of 25 pounds of potash per acre, suggest Extension Circulars 300 and 314, prepared by E. D. Alexander, agonomist, Georgia Extension Service.

THE EFFECT OF LIMING MATERIALS ON THE SOLUBILITY OF POTASSIUM COMPOUNDS IN THE SOIL

(Continued from page 9)

burnt lime. In one series the amounts represent the potassium leached from the surface soil alone. In a parallel series, the leachings from the same surface soil passed through an underlying one-foot depth of red clay subsoil.

The data of Table 7 show the respective disparities between the larger amount of potassium leached from the unlimed soil and the smaller amounts that were leached from the same soil plus any one of the several liming materials during the 26-year period subsequent to the single incorporation of those materials. These figures show that each of the seven liming materials caused a substantial diminution in the amount of potassium leached. The range of the repressive effect was between a minimum of 76 pounds and a maximum of 141 pounds. These effects were registered by a soil that is fairly well supplied with mineral forms of potassium, although its supply of available or exchangeable K has been depleted. The amounts of K leached per acre per annum, therefore, are small, approximately 10 pounds.

The second line of values in Table 7 shows the disparities between the outgo of K from unlimed soil plus subsoil, and limed soil plus unlimed subsoil. In these comparisons, the excessive quantities of the incorporated liming

materials imparted a high concentration of either calcium or magnesium bicarbonate to the rainwater leachings, and these enriched leachings from the limed surface soil caused in the subsoil the same repressive effect upon the outgo of K as that which had been brought about in the upper limed zone.

This brings up a point that should be stressed. The repressive effect of rational incorporations of liming materials upon the solubility of soil potash is limited to the zone of incorporation. For example, if an eight-inch depth of soil is limed in the upper half, the effect of the added liming material in that half of the soil is different from the effect induced in the lower unlimed half of the soil. The neutral salts generated in the upper limed half are capable of bringing about some liberation of potassium in the lower unlimed zone. When a preponderant incidence of the soluble salts of one element induces such a liberation, the phenomenon is referred to as base exchange.

In field soils, however, the actual exchange amounts to a small fraction of the potential capacity of the neutral salts to effect the liberative reaction. In contrast, the expression "reciprocal repression" is used to connote the repressive effect of basic forms of calcic and magnesic materials upon each other and to connote the fact that base exchange does not take place in the zone wherein the liming materials are incorporated. The term "reciprocal repression" was intended primarily to register the parallel phenomena as to the repressive effect of additive high-calcic liming materials upon the leachability of native supplies of magnesia and the reverse effect of additive high-magnesic materials upon the outgo of the native supplies of calcium.

The long-continued experiments at the Tennessee Station have shown that heavy additions of any type of liming material will exert a repressive effect upon the solubility of the potassium content of the limed zone of the soil. A high-calcic liming material may cause a decrease in the solubility of both the potassium and the magnesium content of the soil, whereas an added magnesic liming material will cause a decrease in the solubility of the soil's content of both potassium and calcium. Dolomite and limestone exert the same effect upon soil potash. The overall effect of dolomitic limestone in comparison with limestone in resultant proportions of Ca and Mg in the rainwater leachings is, however, a separate problem that cannot be dwelt upon here.

Experiments have shown that these several repressions in solubilities are registered definitely by the composition of the plant ash. Certain plant culture studies with tobacco, alfalfa, and wheat have shown that liming may diminish the K content of the plants. Progressive increases in soil incorporations of either ordinary limestone or dolomite or their oxide derivatives will affect materially the percentage of potassium that will occur in the plant.

It is far from the purpose of this paper to give a black-eye to liming. Nevertheless, it can be stated conservatively that a soil liming tends to create a potash problem. Interpretation of the many results over an extended period indicates that the lower the soil's content of potassium in the readily available form, the greater the probability that liming will induce a chemically determinable effect upon the solubility of that potassium content and will exert a definite effect upon the plant growth and incidence of symptoms of potassium deficiency.

It is to be stressed, however, that the indications as to the effect of liming upon potassium availability have been noted for taprooted plants and those of limited root development—corn, tobacco, and grain crops. It is yet to be demonstrated that liming diminishes the uptake of potassium by clovers and other lime-loving plants of extensive root development.

TABLE 7—POUNDS OF K LEACHED PER 2,000,000 POUNDS OF A CUMBERLAND SILT LOAM INFLUENCED BY SEVEN LIMING MATERIALS—INCORPORATED AS 32-TON CaO—EQUIVALENT TREATMENTS*

Disparities between the 26-year outgo of K from the untreated soil and the outgo from the same soil limed with

	Burnt lime	Magnesia	Pptd. $CaCO_3$	Pptd. $MgCO_3$	Limestone	Dolomite	Magnesite
Disparity in the outgo from the surface soil..	76	130	99	126	112	130	141
Disparity in the outgo from the surface soil and one foot of subsoil..................	161	194	172	216	187	186	192

* Similar values were obtained by the use of the same seven materials at the rates of 8-ton and 100-ton CaO equivalence.

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BUYERS' GUIDE

For an Alphabetical List of all the Advertisers, see page 33

BUCKETS—For Hoists, Cranes, etc., Clam Shell, Orange Peel, Drag Line, Special; Electrically Operated and Multi Power
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.

BURNERS—Sulphur
Chemical Construction Corp., New York City.

BURNERS—Oil
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.

CABLEWAYS
Hayward Company, The, New York City.

CARBONATE OF AMMONIA
American Agricultural Chemical Co., New York City.
DuPont de Nemours & Co., E. I., Wilmington, Del.

CARS—For Moving Materials
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CARTS—Fertilizer, Standard and Roller Bearing
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

CASTINGS—Acid Resisting
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Duriron Co., Inc., The, Dayton, Ohio.

CASTINGS—Iron and Steel
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CEMENT—Acid-Proof
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

CHAIN DRIVES—Silent
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHAINS AND SPROCKETS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHAMBERS—Acid
Chemical Construction Corp., New York City
Fairlie, Andrew M., Atlanta, Ga.

CHEMICAL APPARATUS
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Duriron Co., Inc., The, Dayton, Ohio.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

CHEMICALS
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
Bradley & Baker, New York City.
DuPont de Nemours & Co., E. I., Wilmington, Del.
Huber & Company, New York City.

CHEMICALS—Continued
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Phosphate Mining Co., The, New York City.
Wellmann, William E., Baltimore, Md.

CHEMICAL PLANT CONSTRUCTION
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHEMISTS AND ASSAYERS
Gascoyne & Co., Baltimore, Md.
Shuey & Company, Inc., Savannah, Ga.
Stillwell & Gladding, New York City.
Wiley & Company, Baltimore, Md.

CLUTCHES
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CONCENTRATORS—Sulphuric Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

CONDITIONERS AND FILLERS
American Limestone Co., Knoxville, Tenn.
Dickerson Co., The, Philadelphia, Pa.
Phosphate Mining Co., The, New York City.

CONTACT ACID PLANTS
Chemical Construction Corp., New York City

COPPER SULPHATE
Tennessee Corporation, Atlanta, Ga.

COTTONSEED PRODUCTS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

CRANES AND DERRICKS
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

CYANAMID
American Agricultural Chemical Co., New York City
American Cyanamid Co., New York City.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Jett, Joseph C., Norfolk, Va.
Wellmann, William E., Baltimore, Md.

DENS—Superphosphate
Chemical Construction Corp., New York City.
Stedman's Foundry and Mach. Works, Aurora, Ind.

A Classified Index to Advertisers in "The American Fertilizer"

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SCALES—Including Automatic Bagging
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SCRAPERS—Drag
Hayward Company, The, New York City.

SCREENS
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SEPARATORS—Air
Sackett & Sons Co., The A. J., Baltimore, Md.

SEPARATORS—Including Vibrating
Sackett & Sons Co., The A. J., Baltimore, Md.

SEPARATORS—Magnetic
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SHAFTING
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SHOVELS—Power
Link-Belt Company, Philadelphia, Chicago.
Link-Belt Speeder Corporation, Chicago, Ill., and Cedar Rapids, Iowa.
Sackett & Sons Co., The A. J., Baltimore, Md.

SPRAYS—Acid Chambers
Monarch Mfg. Works, Inc., Philadelphia, Pa.

SPROCKET WHEELS (See Chains and Sprockets)

STACKS
Sackett & Sons Co., The A. J., Baltimore, Md.

SULPHATE OF AMMONIA
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Hydrocarbon Products Co., New York City.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

SULPHUR
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Freeport Sulphur Co., New York City.
Texas Gulf Sulphur Co., New York City.

SULPHURIC ACID
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M. Charleston, S. C.

SULPHURIC ACID—Continued
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Wellmann, William E., Baltimore, Md.

SUPERPHOSPHATE
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Wellmann, William E., Baltimore, Md.

SUPERPHOSPHATE—Concentrated
Armour Fertilizer Works, Atlanta, Ga.
International Minerals & Chemical Corporation, Chicago, Ill
Phosphate Mining Co., The, New York City.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.

SYPHONS—For Acid
Monarch Mfg. Works, Inc., Philadelphia, Pa.

TALLOW AND GREASE
American Agricultural Chemical Co., New York City.

TANKAGE
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Smith-Rowland, Norfolk, Va.
Wellmann, William E., Baltimore, Md.

TANKAGE—Garbage
Huber & Company, New York City.

TANKS
Sackett & Sons, Co., The A. J., Baltimore, Md.

TILE—Acid-Proof
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.

TOWERS—Acid and Absorption
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

UNLOADERS—Car and Boat
Hayward Company, The, New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.

UREA
DuPont de Nemours & Co., E. I., Wilmington, Del.

UREA-AMMONIA LIQUOR
DuPont de Nemours & Co., E. I., Wilmington, Del.

VALVES—Acid-Resisting
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Duriron Co., Inc., The, Dayton, Ohio.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

WHEELBARROW (See Carts)

ZINC SULPHATE
Tennessee Corporation, Atlanta, Ga.

ALPHABETICAL LIST OF ADVERTISERS

For Classified Index, See Pages 28 to 32, Inclusive

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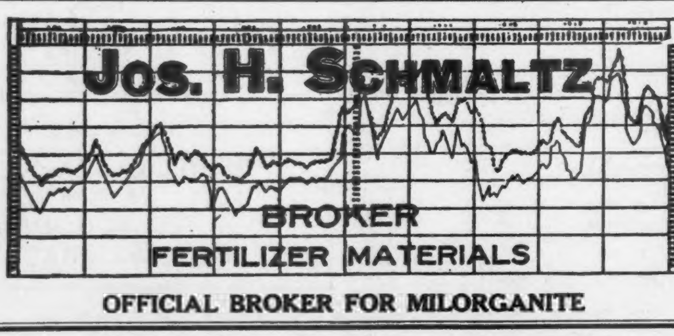

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